BUNGEE BARBIE

Barbie is an adventure seeker to the MAX!!! She loves the thrill of death defying activities. She believes the adrenaline rush makes her hair more lustrous and her waistline thinner; so she will pay big bucks to the company which gives her the most thrilling ride. In the back of her mind though, she wants to be sure that she’s really safe.

Your task is to design a bungee jump for Barbie that gives her the greatest thrill while still ensuring that she is safe. This means that she should come as close as possible to the ground without hitting the floor.

CONJECTURE (PREDICTION)

I believe that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the maximum number of rubber bands that will allow Barbie to safely jump from a height of 400cm.

PROCEDURE

To design the bungee line, follow the steps below

□ Gather the following materials:

1. About 30 rubber bands all the same size
2. A meter ruler & 30 cm ruler
3. A Barbie or some other doll (ie: Ninja Turtle)

Figure

1. A pencil
2. Graph paper

□ Measure Barbie’s height without rubber bands first. Make sure she is

completely stretched out with her hands at her sides. (You may need

to tie Barbie’s hair back so that you can get an accurate reading.)

□ Connect 2 rubber bands with a slipknot. (Figure 1)

□ Then wrap one end repeatedly around Barbie’s ankles. Be sure the

rubber band is on tight enough not to fall off when she is being

Figure

dropped. (Figure 2)



□ Drop Barbie from the top of a meter ruler, (Figure 3) and measure the lowest point that her

head reaches. This is the tricky part. You need to observe the LOWEST spot her head

reaches during the bounce. The final resting spot is NOT the lowest spot. You should repeat

each jump several times and take the average, to ensure accuracy. It really helps to have

another person watch too. Accuracy is important – Barbie’s life could depend on it!

□ Repeatedly attach additional rubber bands for each new jump, measure the jump

distance and record the results in the data table.

Figure

Results

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of rubber bands | Jump distance in centimetres  Trial 1 | Jump distance in centimetres  Trial 2 | Jump distance in centimetres  Trial 3 | Jump distance in centimetres  Trial 4 | Jump distance in centimetres  Trial 5 | Average Jump distance in centimetres |
| 0 |  |  |  |  |  |  |
| 1 |  |  |  |  |  |  |
| 2 |  |  |  |  |  |  |
| 3 |  |  |  |  |  |  |
| 4 |  |  |  |  |  |  |
| 5 |  |  |  |  |  |  |
| 6 |  |  |  |  |  |  |
| 7 |  |  |  |  |  |  |
| 8 |  |  |  |  |  |  |
| 9 |  |  |  |  |  |  |
| 10 |  |  |  |  |  |  |

Look for any numerical irregularities. If any numbers in either your data table or graph do not seem to fit, you may like to re-do the experiment where the data appears ‘abnormal’.

Modelling using a spreadsheet

A spreadsheet is a useful tool for helping us set up mathematical models so that we can make predictions.

□ Use an Excel spreadsheet to plot your data and fit an equation to it. To do this:

1. Open Excel. Enter the heading ‘number of rubber bands’ in Column A, and the heading ‘jump distance’ in Column B. Enter the data from your table.
2. Graph these results using: Chart Wizard – XY scatterplot.
3. Use Excel to produce a **line of best fit**:
   1. Chart menu: Add trendline
   2. Type: Linear, Options: display equation on chart
   3. Make sure that your axes are appropriately labelled
4. Save and print your chart

OR without TECHNOLOGY

□ Now that you have a significant amount of data, set up a **titled** and **labeled** graph, and plot your

data.

□ Draw a line of best fit.

□ Select two points of your line, write their coordinates, and determine the gradient of your line using the

gradient formula: m = . What does it represent in this context? ……………………………………

□ Substitute the gradient you found in the step above and one of your two points into the equation **y=mx+b**,

and solve for **b**. Then write the equation for your line of best fit …………………………………………

□ Use your equation to determine the maximum number of rubber bands needed so that Barbie could still

safely jump from 400cm …………………………………………………………………………………

□ Now consider the SAFETY issue vs. the THRILL issue.

If you use the maximum number of rubber bands that you determined above, Barbie’s head may reach the floor, she will crack open her skull, and die. You will then be sued for negligence and will lose your business and owe her family millions of dollars that you don't have.

On the other hand, if you shorten the bungee line TOO MUCH, the ride may not be thrilling enough, and Barbie will pay her big bucks to your competitor. You will lose clients and your business will suffer.

So **make a decision on how many rubber bands you want to use**, then attach that many rubber bands to Barbie's line using slipknots like above.

□ Now it's time to drop her and see if she dies or has a great time.

Discussion

Based on your data, how many rubber bands are needed for Barbie to safely jump from a height of 400 centimetres?

How did your final decision on the maximum number of rubber bands needed for Barbie’s bungee compare to the conjecture you made before doing the investigation?

What is the minimum height from which Barbie should jump if 25 rubber bands are used? ……………….

How do you think the type and width of the rubber bands might affect the results?

Do you think the age of the rubber bands would affect the results? What would happen?

If Barbie were to gain weight (or maybe do a Tandem Bungee with Kamikaze Ken), would you need to use more or fewer rubber bands to achieve the same results? Explain.

[Extension]

Conjecture a relationship between the amount of weight added and the change in the number of rubber bands needed.

Reflection

In what ways did you contribute to the group while working on this investigation?

Other comments: